



## **A simulation of the effect of TWD (tool wear per discharge) estimation error on the depth of machined surfaces in micro-EDM milling**

**Puthumana, Govindan; Bissacco, Giuliano; Hansen, Hans Nørgaard**

*Publication date:*  
2016

*Document Version*  
Early version, also known as pre-print

[Link back to DTU Orbit](#)

*Citation (APA):*  
Puthumana, G., Bissacco, G., & Hansen, H. N. (2016). *A simulation of the effect of TWD (tool wear per discharge) estimation error on the depth of machined surfaces in micro-EDM milling*. Abstract from XXVII CIRP Sponsored Conference on Supervising and Diagnostics of Machining Systems, Karpacz, Poland.

---

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

# **A simulation of the effect of TWD (tool wear per discharge) estimation error on the depth of machined surfaces in micro-EDM milling**

Govindan Puthumana, Giuliano Bissacco, Hans Nørgaard Hansen

Department of Mechanical Engineering, Technical University of Denmark, Lyngby, Denmark.

## **Abstract**

In micro-EDM milling, real time electrode wear compensation based on tool wear per discharge (TWD) estimation permits the direct control of the position of the tool electrode frontal surface. However, TWD estimation errors will generate a self-amplifying error on the tool electrode axial depth. A simulation tool is developed to calculate the effects of errors in the initial estimation of TWD and its propagation effect with respect to the error on the depth of the cavity generated. Simulations were applied to micro-EDM milling of a slot of 5000  $\mu\text{m}$  length and 50  $\mu\text{m}$  depth, with a segment length of 100  $\mu\text{m}$  and layer thickness of 1  $\mu\text{m}$ , and TWD estimation errors ranging from -10% to +10%. In order to validate the results obtained using simulations, slot milling experiments were performed on a SARIX SX-200 micro-EDM machine with tungsten carbide tool electrodes and Stavax steel workpieces. Simulations and experimental results show that with a variation in TWD estimation error from +1% to +5%, the maximum error in the geometry of micro-EDM milled profile varied from +6.14% to +40.52%. The results of depth predicted using the simulation and the average depth obtained using experiments were found to agree well within an error of 5%.

**Keywords:** EDM, Precision machining, Tool electrode wear, simulation, error propagation